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TECNET RESEARCH AND DEVELOPMENT INITIATIVES

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ABSTRACT

BACKGROUND - THE TECNET VISION STATEMENT: The Test and Evaluation Community Network (TECNET) is governed by a Tri-service Steering Committee which reports to the Joint Commander's Group for Test and Evaluation (JCG(T&E)). In keeping with its JCG(T&E) approved TECNET Project Management Plan (PMP), the TECNET Steering Committee adopted the following TECNET Vision Statement in 1991:

"To systematically migrate existing TECNET resources to a standards compliant, multi-level secure communications and processing capability which links DoD test and evaluation entities to a shared, but controlled user community information resource".

TECNET GENERAL RESEARCH AND DEVELOPMENT: The life blood of ongoing TECNET operations is the continual improvements and user support provided by a leading University. This Research and Development contract directly contributes to the continued well being of TECNET. This contract sustains TECNET as a state of the art communication tool for its users who are continually increasing their capabilities. They expect their T&E network to keep pace. This is particularly true as more executive users adopt TECNET.

PLANNED MULTI-LEVEL SECURE (MLS) EXPERIMENTS: Near term MLS experiments are designed to lay a foundation for longer term objectives. The foremost characteristic of the second generation TECNET is that host computers and all associated user nodes be eventually capable of processing information ranging in classification from UNCLASSIFIED through SECRET, depending upon the nature of the information requirements of the user. Specific components of the TECNET MLS plan include secure network devices and MLS accredited hardware running MLS accredited software. These characteristics will permit TECNET to operate in the requisite secure mode per COMSEC directives, support T&E program officials and T&E practitioners with timely and meaningful value added information concerning T&E, and permit near real time exchange of T&E data. MLS experiments are tri-service in nature.

DATA DISTRIBUTION RESEARCH: The TECNET Distributed Data Plan calls for tri-service participation in building a T&E common data dictionary in 1992. The RCC agreement to form a common Range data Dictionary Group sets the stage for such a cooperative effort. One necessary and highly desired product of this process is a detailed catalog of all known and emerging T&E related data bases. TECNET plans to field and

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populate such a catalog of T&E data bases during 1992. Further, using the generic data extraction and conversion tool offered to TECNET, the demonstration of third party data base data population from the ranges will be accomplished. A significant effort has been undertaken to perform the necessary analysis to establish this tool to work with the RCC defined common data elements and the target data bases. Finally, TECNET proposes to develop specific training materials in print and computer based training media, as well as on site training support, for selected data bases of widespread value to the T&E community.

PART 1: BACKGROUND

1. BACKGROUND - THE TECNET VISION STATEMENT: The Test and Evaluation Community Network (TECNET) is governed by a Tri-service Steering Committee which reports to the Joint Commander's Group for Test and Evaluation (JCG(T&E)). In keeping with its JCG(T&E) approved TECNET Project Management Plan (PMP), the TECNET Steering Committee adopted the following TECNET Vision Statement in 1991:

"To systematically migrate existing TECNET resources to a standards compliant, multi-level secure communications and processing capability which links DoD test and evaluation entities to a shared, but controlled user community information resource".

1.1. DESCRIPTION OF TECNET: TECNET has existed as a means of electronically exchanging unclassified information between Test and Evaluation (T&E) practitioners since 1983. TECNET currently provides unclassified electronic mail data base, facsimile and bulletin board services to the T&E community via an accredited C-2 unclassified host computer operated and maintained by the Naval Air Warfare Center - Aircraft Division, Patuxent River, Maryland. Department of Defense (DoD) packet switched network capabilities are provided via the MILNET component of the Defense Data Network (DDN). A DoD approved FTS-2000 packet switched data network access augments DDN where necessary. A fully accredited system high secret TECNET C-2 computer exists at Aberdeen Proving Ground, Maryland. Access to this system is via STU-III SACS dial-in or via the Defense Secure Network (DSNET) component of DDN. The classified TECNET system operates identically to the unclassified system with the exception that all forms of output are appropriately marked with the security classification. TECNET works closely with its JCG(T&E) sister committee, the Multi-service Test Investment Review Committee (MSTIRC). TECNET houses the high level DoD Test and Evaluation Assets Data Base on behalf of OSD. Beginning in 1992, the System High Secret TECNET system will house the Operational Test and Evaluation Coordinating Committee's (OTECC) data base which links DoD Oversight List test articles to threat resources. TECNET also holds a number of prototype capabilities for the Range Commander's Council (RCC) community. Presently TECNET supports a growing population of over 2,000 validated users from both the operational and developmental T&E communities in all three services.

1.2. TECNET USER COMMUNITY: Traditionally, TECNET focused on the DoD T&E infrastructure, particularly range organizations associated with the Major Range and Test Facility Base (MRTFB). Based upon the ratio of operational T&E individuals to developmental T&E individuals within the services, the level of service representation of operational testers is significant and growing. The advent of the secure version of TECNET has provided ample incentive for increased Operational T&E participation. Now, TECNET is also becoming a prime information tool for the

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customers of T&E, the T&E arms of the acquisition Program Management Offices (PMO) in DoD. In order to accomplish this OSD desired goal, the nature of TECNET is changing significantly. TECNET must continue to support electronic communications for its established user base. At the same time, TECNET must provide T&E information of value to the DoD acquisition PMOs to enable them to use this service as opposed to more costly capabilities typically provided by captive contractors. Such capability requires efficient data management and security capabilities.

PART 2: TECNET GENERAL RESEARCH INITIATIVES

2. TECNET GENERAL RESEARCH AND DEVELOPMENT: The life blood of ongoing TECNET operations is the continual improvements and user support provided by a leading University. This Research and Development contract directly contributes to the continued well being of TECNET. This contract, sustains TECNET as a state of the art communication tool for its users who are continually increasing their capabilities. They expect their T&E network to keep pace. This is particularly true as more executive users adopt TECNET.

2.1. RECENT GENERAL TECNET RESEARCH RESULTS: Recent research initiatives have yielded the following results culminating in 1991: 1) A secure version of TECNET running at the system high secret level with all appropriate accreditation and security handling markings, 2) full facsimile services integrated with TECNET electronic mail, 3) a flexible file transfer system to easily accommodate emerging techniques as they become available, 4) a complete remake of the Test and Evaluation Assets Data Base, 5) ongoing support of the Multiservice Test Investment Review Committee (MSTIRC), 6) ongoing support of the Range Commander's Council (RCC), 6) a greatly improved line editor interface eliminating erroneous use of arrow keys and the potential to overwrite buffers and 8) a myriad of user requests for enhanced capability.

2.2. CURRENT AND FUTURE TECNET GENERAL RESEARCH INITIATIVES: The following list has been prepared by the TECNET team and approved by the chairman of the TECNET Steering Committee. It represents ongoing major TECNET developmental initiatives that involve beta testing. These initiatives are also related to direct user requests and requirements. They generally involve aggregated user requirements as opposed to single user requests. Relative weights and priorities are not to be inferred except in the grossest sense from this list. Nor does this list take into consideration the myriad of changes and bugs offered by users via all sorts of messages. Such tasks are tracked separately and reported via their associated *bugbox and *comments bulletin boards residing on TECNET.

INTRODUCED IN FIRST HALF OF 1992:	STATUS:
Access via FTS-2000 - 9600 baud dial-up	Active
KeyPHRASE lookup capability	Active
Commerce Business Daily lookup feature	Active
Multiple days of Aerospace Daily	Active
USAF Electronic Combat Handbook	Active
Sliding Windows Kermit	Relaxed mode
DoD Directives	Active
Interoperability Menus	Active

ACTIVE BETA TEST ITEMS (as of 6/20/92):
 Entire TECNET Secure System via STU-III
 New double column menu capability
 Simplified T&E Assets Data Base access
 Expert FTP and Archie
 DTEPI Course Bulletin Board (*tecourse)
 Secure Internal Markings
 Secure binary transfers
 Secure marked compressed file
 Routing of incoming FAXes
 Improved Facsimile Net Admin. Tools

STATUS
 Active participation encouraged
 Active *betabug comment encouraged
 Active *betabug comment encouraged
 Active *betabug comment encouraged
 Undergoing DTEPI review
 Secure beta (via STU)
 Secure beta (via STU)
 Secure beta (via STU)
 Active *betabug comment encouraged
 Active *betabug comment encouraged

COMING SHORTLY TO BETA OR PRODUCTION
 T&E Assets Data Base data capture
 TECNET Novice Menu System
 Totally revised File Repository
 Rational BREAK processing
 Expert user's area of the menu system
 TUFTS Invoked from menued display pages

Improved version coming to beta
 Coming to Beta
 Coming to Beta
 Coming to beta
 Coming to beta
 Coming to beta

ONGOING EFFORTS
 Jove Editor Improvements
 8N1 interface under DDN w/o echo delay
 Internal security protection
 MSTIRC Data Base development
 MSTIRC Data Base data output tools
 T&E Assets Data Base
 Conference capability

Active development
 Active exploration
 Ongoing development
 Awaiting new CRB direction
 Under development
 Production data being positioned
 Deferred, requires total rewrite

LONG TERM DEVELOPMENT
 Multi-level Secure TECNET Software
 Alternative FAX software
 File repository, file transfer overhaul
 File encryption capability
 TCP/IP across modems
 Graphics User Interface (Mac-like)

Feasibility analysis
 Exploration
 Planned for summer 1992
 Planned for 1992
 Feasibility study
 Feasibility study

PART 3: TECNET MULTI-LEVEL SECURE RESEARCH INITIATIVE

3. **TECNET MULTI-LEVEL SECURE FOUNDATION:** TECNET has proved its utility in supporting the unclassified data and communications needs of the joint service Test and Evaluation (T&E) communities. Although TECNET still continues to gain productive users from T&E organizations in all three services, it cannot remain as presently configured. A second generation TECNET capability is required to meet the data communications requirements of the T&E community and its customer base in the 1990s. While the existing TECNET classified and unclassified capability can handle emerging electronic communication requirements in the short term, the current separated unclassified and classified networks featuring electronic mail augmented by information support cannot provide needed services in the DoD T&E environment. Rather, there is evidence which mandates that TECNET must be fully capable of fielding a Multi-Level Secure (MLS) network capable of handling geographically distributed data at differing classification levels. This goal is shared among

strategic network planners within the Pentagon and must be met in kind within the field environment. This mandate is particularly true if T&E information resources are to be managed economically and effectively within DoD. At present, TECNET has obtained secure network devices at no programmatic cost via COMSEC channels. Acquisition of a number of low cost experimental tools was completed in 1991 using duly allocated TECNET R&D funds from OSD, DT&E(TFR). One set of tools supports a series of MLS experiments aimed at operating under Blacker technology on the DDN MILNET. These experiments were designed in full cooperation with the Defense Information Systems Agency (DISA) DDN program Office as documented in a Memorandum of Agreement (MOA). A second set of tools support experimental operation of remote MLS Personal Computers (PC) operating via STU-III phones. These experiments are in full cooperation with the National Security Agency (NSA). These network components were acquired so that TECNET may learn what it takes to manage a MLS capability prior to moving to a specific hardware/software/MLS Data Base capability. Specific FY92 funding support for these experiments and other ongoing TECNET user interface enhancements has already been identified within the Office of the Secretary of Defense (OSD) at the level of \$200,000. Further, the TECNET Steering Committee approved R&D budget calls for acquisition of the actual network assets as early as 1993 or as soon thereafter as is practical.

3.1. MLS INTERFACE STRATEGY: The technical concepts underlying the second generation of TECNET are well defined. The concept of Multi-Level Secure (MLS) network capabilities has been demonstrated in the laboratory through the NSA Blacker Program operating under the prototype DISNET 1 component of DDN. The NSA Caneware program also offers an alternative STU-III compatible approach to the MLS network environment. Increasing numbers of systems level and application software products, such as trusted PC operating systems, are becoming available which will provide an acceptable level of trust in the requisite MLS computer environment. So long as TECNET software requirements do not become increasingly complex, such trusted products can support the existing type of TECNET environment. The new generation of low cost Reduced Instruction Set Computer (RISC) hardware can well support the known technical performance requirements, including those necessitated by the trusted software. Increased network bandwidth will most likely not be met through the DSNET and MILNET but may be met via increased capability secure dial in devices such as STU-III systems or other secure access capabilities. The nontechnical issues of security accreditation, data base maintenance and acquisition approvals will require attention to limitations in existing doctrines concerning such matters.

3.2. NEAR TERM NETWORK SECURITY STRATEGY: The services and the component organizations which utilize TECNET are all subject to varying degrees of rigor in how local systems are accredited to operate in secure mode. The ability of users to gain appropriate security accreditation to operate from their local environments could become a significant initial issue for the effective use of a secure TECNET computer. In such an environment, the nature of the overall network accreditation for a MLS TECNET could become equally problematical. It will become important, therefore, to strive for multi-service commonality of accreditation policies and procedures when it comes to TECNET access. These accreditation practices should be oriented to satisfying practical user needs with pragmatic security precautions. To counteract this problem in the short term, TECNET has promulgated a security manual under JCG(T&E) endorsement which spells out the minimum requirements for obtaining access to classified TECNET assets. Through empirical documentation of a series of experiments involving the recently acquired MLS components, TECNET shall also continue to formulate and forward documented recommendations for

acceptable security guidelines. Further, TECNET shall continue to seek the assistance of security related organizations to voluntarily identify and correct security shortfalls. These organizations include the National Security Agency, the MLS Technology Insertion Program, the Defense Information Systems Security Program, and the Acquisition Systems Protection Office. These initial steps lay the groundwork for understanding the practical management of a MLS network in the near future. A TECNET Plan of Action and Milestones (POA&M) exists for ongoing execution of FY92 MLS experiments.

3.3. PLANNED IMPROVEMENTS FOR THE LONG TERM: The near term experiments are designed to lay a foundation for longer term objectives. The foremost characteristic of the second generation TECNET is that host computers and all associated user nodes be eventually capable of processing information ranging in classification from UNCLASSIFIED through SECRET, depending upon the nature of the information requirements of the user. Specific components of the TECNET MLS plan include secure network devices and MLS accredited hardware running an MLS accredited Relational Data Base Management System (RDMS). Strict access controls must be imposed to insure that users gain access to only those data for which they have a demonstrated need to know as validated by the designated manager of that data. These access controls must support access to data of some granularity within the various data bases. Data bases must be well defined, supported and maintained with sufficient detailed information to be of real utility to identified user groups. The TECNET user interface must remain straight forward, and in terms of data base access, must be simplified to permit data localization via menu systems which use hierarchies of key words. Finally, the size of the data path must be vastly increased to support exchange of voice, video, graphics, facsimile and large files in a variety of digital formats. These characteristics will permit TECNET to operate in the requisite secure mode per OPSEC/COMSEC/COMPUSEC directives, support T&E program officials and operational and developmental T&E practitioners with timely and meaningful value added information concerning T&E, and permit near real time exchange of T&E data.

PART 4: TECNET DATA DISTRIBUTION RESEARCH INITIATIVE

4. DISCUSSION: THREAT AND RANGE RESOURCE DATA REQUIREMENT: There are numerous data bases located within various T&E organizations containing data of interest to the entire T&E community. Data includes information on certain test schedules, threat and range assets available at various ranges and test facilities, proposed test infrastructure investments, test plans, test methodologies employed for specific test programs, test results on a wide variety of defense systems, test assets used in support of specific test programs, and other T&E-related information. A proliferation of databases within the T&E community is occurring. Technology trends suggest such data bases will continue to proliferate. In fact, the existing draft Memoranda of Agreement (MOA) for the T&E Reliance Studies initiated in FY91 each call for the development of Reliance oriented resource based T&E data bases. These 15 new data bases and other known data bases require that data be collected and updated from ranges and other T&E organizations. Such collection activity adversely drains available resources. Redundant data collection to satisfy individual database requirements creates additional work for the providers while providing no visible payback to the organizations polled. In addition, responses are often inconsistent. The documents provided are often outdated, the required data may not be readily available, no standard terminology

exists, and there are misconceptions of the validity of the data requests. In short, organizational resources are drained by the multiple data requests and the T&E organizations are often not able to satisfy the requests for data. Further, the required threat and range resource data exists in many forms, ranging from hard copy data in files to data files in PC-based and mainframe computer systems. Access methods to this information also takes on many forms, ranging from on-line computer-to computer retrieval of selected data, to electronic mail or telephonic request for desired data from a data base administrator. Computer-aided access to this range information could optimize the overall effort, eliminate redundant rework of data, and greatly facilitate the data collection and distribution effort.

4.1. EFFORTS ALREADY UNDERTAKEN: In March 1991, under a TECNET initiated proposal, a number of T&E related data bases formed a loose consortium. The objective of this informal federation was to determine if there was a way of eliminating collection redundancy among these data bases: The data bases which participated in the period between March 1991 and October 1991 included:

- a. The Automated Range Resource Inventory and Investment Planning System (ARRIIPS), sponsored by the Air Force Operational Test and Evaluation Center (AFOTEC),
- b. The OTECC Data Base sponsored by the OTECC,
- c. The Long Range Planning System (LRPS) sponsored by the Army Intelligence Agency,
- d. The Inter-range Scheduling System (ISS), sponsored by the Global Range Capability (GRANCAP) through the Consolidated Space Test Command (CSTC) under FY91 funding,
- e. The MSTIRC Data Base, sponsored by the JCG(T&E),
- f. The Army Test Facilities (TESTFACS) Data Base, sponsored by the Army's PMITTS, and
- g. The DoD T&E Assets Data Base, sponsored by OSD DT&E(TFR).

In October 1991, this group produced a report listing the components of each data base in a common data dictionary format. This report identified five significant sources of data, the degree of redundancy by source and the potential unique areas of each participating data base. The conclusion was that the payoff was worth the effort. A common collection vehicle could be developed, if further agreement on like data elements could be achieved. The greatest potential payoff for the participating data bases was determined to be in the area of range resources. Consequently, the group supported a proposal to go forward to the Range Commander's Council (RCC) to seek further formal action from the data providers. After receiving the concurrence of its Steering Committee, TECNET carried such a proposal to the Executive Committee of the RCC in October 1991. The RCC Executive Committee concurred with the proposal and directed that TECNET take the lead in forming a RCC group to build a common Range Data Dictionary.

4.2. GENERIC DATA DISTRIBUTION TOOLS: The RCC proposal was made possible because of three available technologies to manage distributed data. The concept of a common data dictionary is the first technology. It is at the heart of efficiently sharing data. It is also at the heart of OSD's Corporate Information Management (CIM) initiative. Such a dictionary for Ranges and T&E organizations is already mandated in concept by CIM. If the entire DoD T&E community cooperates at this time, it will be ready to meet CIM on its own terms well before CIM can effectively implement it's existing mandates. Further, such cooperation represents a bottoms-up Reliance effort and further promotes sharing in a draw down environment. The second

available technology is a federation of computers nationally linked by common protocols known as the Internet. The availability of the Internet, in which both the Defense Data Network (DDN) and TECNET are involved, permits computers to readily transfer specific data between one another by methods not readily visible to users. If these data are commonly defined, the value added of such network transactions is great. In essence, key data need only be captured once and under well defined sharing agreements, used frequently by other organizations. The third available technology involves the ability to interchange data among different data bases. In cases where existing data is already available in a given format, the only missing component is the ability to transform that data from it's native format to the format required by the target data base. The TECNET proposal to the RCC was based upon the availability of such a generic software tool to automatically perform such extractions and transforms. This tool, which gained notoriety in Desert Storm and is being used by a number of major firms, has been offered to TECNET at no cost for the period of one year.

4.3. DATA DISTRIBUTION TOOLS AVAILABLE: The role of a TECNET data distribution system is to provide the capability for automatic access and retrieval of data from selected ranges and sources. The individual T&E databases will continue to exist, but the efficiency of the data collection and distribution process to satisfy the needs of these T&E data bases will be greatly improved. Specifically, TECNET proposes to populate ARRIIPS and parts of the OTECC data base with the required range data from at least two ranges by means of the tools during CY92. In cases where range data is unavailable, it is expected that ARRIIPS will become the primary local data collection and storage vehicle. The TECNET led RCC effort will assure that the ARRIIPS format is sufficiently rigorous to meet recognized parametric range resource data requirements. ARRIIPS, the most advanced range related data base, has the greatest potential for this role because of its known leadership role in the tri-service arena. Further, the Congressional decision to eliminate GRANCAP funding greatly curtails the ISS as a contender for this important lynch pin role. Similar initiatives in the area of threat data will allow cross sharing of threat data between the OTECC and ARRIIPS data bases. The resulting demonstrations will ultimately be placed into production as the TECNET MLS capability is proven.

4.4. DATA DISTRIBUTION PROPOSAL: The TECNET Distributed Data Plan, based on the TECNET PMP, calls for tri-service participation in building a T&E common data dictionary in 1992. The RCC agreement to form a common Range Data Dictionary Group sets the stage for such a cooperative effort. One necessary and highly desired product of this process is a detailed catalog of all known and emerging T&E related data bases. TECNET plans to field and populate such a data base of T&E data bases during 1992. Further, using the generic data extraction and conversion tool offered to TECNET, the demonstration of ARRIIPS and OTECC data base data population from the ranges will be accomplished. A significant effort has been undertaken to perform the necessary analysis to establish this tool to work with the RCC defined common data elements and the target data bases. Finally, TECNET proposes to develop specific training materials in print and computer based training media, as well as on site training support, for selected data bases of widespread value to the T&E community.

STRUCTURAL EVALUATION OF BIG LOOK ANTENNA RADOME
ON EP-3E ARIES II AIRCRAFT

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The purpose of this evaluation is to determine the structural integrity and flight worthiness of the Big Look antenna radome on the EP-3E Aries II aircraft. The Aries II is a variant of the basic P-3 Orion which is equipped for electronic warfare; the Big Look radome houses a large rotating antenna. The radome is elliptical in vertical cross-section with 12 foot major and 4 foot minor diameters. The construction material is a seven-layer sandwich with 4 epoxy-glass skins and three honeycomb cores. Naval Air Systems Command tasked the Naval Air Warfare Center Aircraft Division (NAWCAD) Patuxent River (formerly the Naval Air Test Center) to perform a flight test program to clear the new radome throughout the existing EP-3E flight envelope.

To this date, static proof-pressure tests have been conducted, and finite-element and computational fluid dynamics studies are in progress. For the proof test, the radome was filled with 1,680 gallons of water and pressurized to 1.4 psi, simulating the loads during an emergency descent. A computational fluid dynamics study is in progress to determine the pressure distribution on the surface of the radome for various airspeeds, angles-of-attack, and sideslip angles; the solver is a potential flow code, the results of which have been verified with inviscid Euler results for selected cases. Surface pressures will be input to the finite-element model, and the calculated strains will be compared to those measured in the flight test program. Dynamic analysis of the radome has been performed to determine natural frequencies and mode shapes; a ground vibration test will be performed to verify the calculated frequencies.

The radome will be instrumented with a number of strain gauges and accelerometers for the flight test. A full structural demonstration including accelerated stalls, rolling pull-outs, dynamic yaw, and emergency descent will be performed to measure the strain and vibrational response of the radome to maneuvers covering the flight envelope. Strain gauge and accelerometer output will be monitored in real time on board the aircraft during the flight test to ensure that critical strain and acceleration levels are not exceeded. Non-destructive inspection of the radome will be performed after each flight using ultrasonics to determine whether or not delaminations or other damage have occurred; calibration standards are currently under development.